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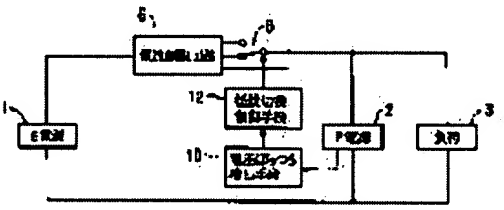
(54) HYBRID POWER SUPPLY CONTROLLING SYSTEM

(57)Abstract:

PURPOSE: To prevent the deterioration of a power source and let the power source keep its functions as a power supply satisfactorily by detecting a specified deterioration starting state of the power source and strengthening the restrictions to output current of an energy source based on the change in voltage of the power source.



CONSTITUTION: When a load 3 is a light one, the current of an energy source (E source) 1 becomes charging current of a power source (P source) 2 and load current and therefore the P source 2 can be charged while the load 3 is being driven. When current which is caused to flow when the terminal voltage of the E source 1 equals that of the P source 2 is the same as the load current, all the load current is supplied by the E source 1 and P source 2 is neither charged nor discharged. When the load of the load 3 gets heavier, both of the E source 1 and the P source 2 is discharged and the load current is supplied by both the E source 1 and the P source 2. Because there is a current limiter circuit 6, the output current of the E source 1 is kept at a set value or below. By this method, the deterioration of the P source 2 can be prevented and therefore the P source 2 can keep its functions enough to serve as a power supply.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the hybrid power control used especially combining two kinds of power sources with respect to hybrid power control.
[0002]
[Description of the Prior Art] Like the power source of an electric vehicle, a load effect is large and the hybrid power source used combining the energy power source (it is called "E power source" below) of long duration Koide force type and the power power source (it is called "P power source" below) of a short-time high power form as a required dc-battery power source which carries out long duration continuation and discharges is used. Generally the initial momentary-current voltage characteristic of these E power sources and P power source comes to be shown in drawing 1 . That is, if the discharge current I increases E power source, terminal voltage V will fall, on the other hand, even if the discharge current increases P power source, terminal voltage is kept almost constant and a voltage drop can emit a high current small. When a hybrid power source was constituted using two kinds of power sources which have a property like the above, as conventionally shown in drawing 2 , the E power source 1 and the P power source 2 connected with juxtaposition to the load 3, and the current-limiting circuit 4 for restricting the amount of currents from E power source was further established in the output side of the E power source 1. This current-limiting circuit 4 is the transistor TR1 for current limiting, the transistor TR2 for a limiting value setup, and resistance R1 and R2. It has.
[0003] In the conventional hybrid power source shown in drawing 2 , at the time of a light load, the current of the E power source 1 turns into the charging current of the P power source 2, and the load current, and the P power source 2 is charged, driving a load 3. Next, it is IP about the current to which the terminal voltage of the E power source 1 becomes equal to the terminal voltage of the P power source 2. The load current is IP if it carries out. When equal, the E power source 1 supplies all the load currents, and the P power source 2 carries out neither charge nor discharge. And if a load becomes large further, both the E power source 1 and the P power source 2 will discharge, and the load current will be provided. Furthermore, he is trying to always keep constant the limit current (for it to be in charge of Above IP in the maximum current which E power source should pay) of the E power source 1 by the current-limiting circuit 4.
[0004]
[Problem(s) to be Solved by the Invention] In the conventional hybrid power source, if the electrical potential difference of each capacitor always is not fixed when P power source is constituted by two or more capacitors, and this dispersion is large and continues operation in the condition as it is according to a discharge-and-charge condition when dispersion, especially a capacitor are electric double layer capacitors, dispersion in some capacitors will become large gradually, that permissible upper limit electrical potential difference will be exceeded, and degradation will be caused. Degradation of some capacitors which constitute P power source produces the problem that the property in which the whole P power source satisfies the function as a power source is unmaintainable.
[0005] Then, this invention is made in order to solve the trouble of a Prior art mentioned above, and it aims at offering the hybrid power control which can maintain the property in which prevent that degradation arises to a power power source (P power source), and it is satisfied with it of the function as a power source. Moreover, this invention aims at offering the hybrid power control which can prevent degradation of this electric double layer capacitor, when an electric double layer capacitor is used as a power power source (P power source).
[0006]
[Means for Solving the Problem and its Function] In the hybrid power control with which this invention has the current-limiting circuit with the 2nd power source in which an output is possible which restricts the output current of the 1st power source of the above while combining and supplying power to a load by time amount shorter than the 1st power source and this 1st power source in order to attain the above-mentioned purpose A degradation detection means for the 2nd power source of the above to deteriorate by repeating charge and discharge, and to detect the predetermined

degradation initiation condition of this 2nd power source, It is characterized by establishing the control means which strengthens a limit of the output current of the 1st power source by the above-mentioned current-limiting circuit based on electrical-potential-difference change of this 2nd power source.

[0007] Thus, in constituted this invention, hybrid power control has the current-limiting circuit with the 2nd power source in which an output is possible which restricts the output current of the 1st power source of the above while combining and supplying power to a load by time amount shorter than the 1st power source and this 1st power source. In such hybrid power control, the 2nd power source deteriorates by repeating charge and discharge, and the predetermined degradation initiation condition of the 2nd power source is detected by the degradation detection means. Consequently, it can prevent that the 2nd power source deteriorates. Moreover, based on electrical-potential-difference change of the 2nd power source, a limit of the output current of the 1st power source by the above-mentioned current-limiting circuit is strengthened by the control means. Consequently, the electrical potential difference of the 2nd power source can increase unusually, or it can prevent that the 2nd power source deteriorates.

[0008] Moreover, as for this invention, it is desirable that the above-mentioned degradation detection means is an electrical-potential-difference change detection means to detect electrical-potential-difference change of the 2nd power source. Thereby, electrical-potential-difference change of the 2nd power source is detected by the electrical-potential-difference change detection means, and the predetermined degradation initiation condition of the 2nd power source is detected based on this electrical-potential-difference change. Moreover, when a control means changes in the direction in which the electrical potential difference of the 2nd power source becomes large, as for this invention, it is desirable to strengthen a limit of the output current of the 1st power source by the above-mentioned current-limiting circuit. Moreover, as for this invention, it is desirable that the 2nd power source consists of two or more power sources.

[0009] Moreover, as for this invention, it is desirable that the 2nd power source is an electric double layer capacitor. Thereby, degradation of the electric double layer capacitor which is easy to produce voltage variation can be prevented. Moreover, as for this invention, it is desirable to detect the supply voltage of the power source which the above-mentioned electrical-potential-difference change detection means divided into a group or each the 2nd power source which consists of two or more power sources, and was divided into these power sources or each by which the group division was carried out. Thereby, even if electrical-potential-difference change of the 2nd whole power source is small, when the electrical potential difference of the power source of size rose ****** part turns into [electrical-potential-difference change of each power source (especially electric double layer capacitor)] more than a predetermined electrical potential difference, it is prevented that the power source deteriorates. Furthermore, as for this invention, it is desirable that a load is the drive motor carried in the electric vehicle.

[0010]

[Example] Hereafter, one example of the hybrid power control of this invention is explained with reference to drawing 3 thru/or drawing 5 . Drawing 3 R> 3 is the whole one example circuit diagram of the control unit of the hybrid power source of this invention. In this drawing 3 , it connects with juxtaposition to the load 3 which is electric load, and the energy power source (E power source) 1 and the power power source (P power source) 2 are established. In this example, a load 3 is a drive motor which drives an electric vehicle. Moreover, the E power source 1 is the power unit of the Koide force mass mold which consists of what compounded any one, such as other power sources, or these which used a fuel cell, an engine electric organ, a lead accumulator, and electrochemical reaction, and supplies supply of the load power to the load 3 which is a drive motor, and charge power to the P power source 2.

[0011] On the other hand, although the P power source 2 charges the electrical and electric equipment without using chemical reactions, such as an electric double layer capacitor, a mass electrolytic capacitor, and a flywheel dc-battery, it consists of what compounded any one or these, performs supply of the load power to a drive motor, and absorption of braking power, and is a power unit in which the charge and discharge of the high power (high current) in which an output is possible with a small voltage drop are possible in time amount shorter than the E power source 1. Here, since output voltage is small when an electric double layer capacitor is used as a P power source, it is used, connecting two or more electric double layer capacitors to a serial. Furthermore, in order to prevent that change by dispersion in the electrical potential difference of the P power source 2 becomes large, it is desirable to connect two or more power sources to a serial and/or juxtaposition as a P power source 2. It is the output side of the E power source 1, and the current-limiting circuit 6 for restricting the amount of currents from the E power source 1 is formed between the P power sources 2. Moreover, the function to restrict the amount of currents supplied to the E power source 1 also has [the drive motor which is a load 3] this current-limiting circuit 6 collectively from this drive motor in regeneration.

[0012] Drawing 4 shows this current-limiting circuit 6 to a detail. It is the transistor current-limiting circuit which was shown in drawing 4 . As shown in this drawing 4 , the current of the E power source 1 is a transistor TR1. Resistance R2 Or resistance R3 It minds and the P power source 2 and a load 3 are supplied. Resistance R2 And resistance R3 It is resistance for current detection, and it is set up so that it may be set to R2 <R3. Moreover, these resistance R2 And resistance R3 It is switched by the resistance change-over switch 8. Now R2, for example, resistance, When it uses, it is

resistance R2. The voltage drop VR 2 to depend is a transistor TR2. When smaller than base emitter operating voltage (when the current which flows resistance R2 is smaller than a programmed current), it is a transistor TR2. It becomes off and is a transistor TR1 at this time. It is turned on. Next, resistance R2 When the flowing current reaches a programmed current, a voltage drop VR 2 is a transistor TR2. It becomes equal to base emitter operating voltage, and is a transistor TR2. It becomes ON and is a transistor TR1. It goes into a current-limiting field and the current on which resistance between collector emitters increases and flows is restricted. That is, it sets in the transistor current-limiting circuit shown in this drawing 4 , and is a transistor TR1. The object for current limiting, and transistor TR2 It operates as an object for a limiting value setup. moreover, resistance R3 the case where it uses -- R2 -- < -- R3 it is -- since -- the programmed current used as the criteria at the time of restricting a current -- resistance R2 It is restricted so that it may become a small value and the output current from the E power source 1 may turn into a small current relatively as compared with the case where it uses.

[0013] As again shown in drawing 3 , the electrical-potential-difference dispersion detection means 10 is formed in the P power source 2. Here, when the P power source 2 is constituted by the electric double layer capacitor, since the electrical potential difference of one electric double layer capacitor is 2.3V, 100 - 200 electric double layer capacitors are connected to a serial as a P power source. In this case, the terminal voltage of each electric double layer capacitor is detected by the electrical-potential-difference dispersion detection means 10. When at least one electric double layer capacitor with which the value of that terminal voltage varies beyond the predetermined value (for example, 0.5V) to the average value of each detected terminal voltage at this time exists, it is detected as those with electrical-potential-difference dispersion. The predetermined degradation initiation condition of the P power source 2 is detected by this electrical-potential-difference dispersion. In this case, although the terminal voltage of all electric double layer capacitors is detected, the terminal voltage of an electric double layer capacitor is detected every five pieces, and you may make it, detect electrical-potential-difference dispersion for example. Thus, even if electrical-potential-difference change of the whole P power source 2 is small by detecting the supply voltage of the power source which divided into a group or each the electric double layer capacitor of a large number which constitute the P power source 2, and was divided into these power sources or each by which the group division was carried out, when electrical-potential-difference change of each electric double layer capacitor becomes more than a size rose ****** predetermined electrical potential difference, degradation of the P power source 2 can be prevented.

[0014] Furthermore, the resistance change-over control means 12 is established. When the electrical-potential-difference dispersion detection means 10 detects electrical-potential-difference dispersion, this resistance change-over control means 12 is resistance R3 about the resistance for current detection in the current-limiting circuit 6 by the resistance change-over switch 8. It switches to a side and the value of the programmed current for current limiting is made small. Next, actuation of the example constituted as mentioned above is explained. At the time of a light load, the current of the E power source 1 turns into the charging current of the P power source 2, and the load current, and a load 3 charges the P power source 2, driving a load 3. Next, it is IP about the current to which the terminal voltage of the E power source 1 becomes equal to the terminal voltage of the P power source 2. The load current is IP if it carries out. When equal, the E power source 1 supplies all the load currents, and the P power source 2 carries out neither charge nor discharge. And if a load becomes large further, both the E power source 1 and the P power source 2 will discharge, and the load current will be provided. Furthermore, the output current from the E power source 1 is maintained below at a predetermined value (programmed current) by the current-limiting circuit 4.

[0015] Next, although the resistance change-over switch 8 is switched by the resistance change-over control means 12, the flow chart which shows change-over actuation of this resistance change-over switch 8 to drawing 5 explains. First, in step S1, each component (component of electric double layer capacitor) electrical potential difference of P power source is detected. Next, in step S2, an electric vehicle judges whether it is an acceleration condition. If it is in an acceleration condition, it progresses to step S3 and is resistance R2 by the resistance change-over switch. A side is cut and replaced. In this case, original current limiting is performed by the current-limiting circuit 6. That is, if it is in an acceleration condition, since a high current will be supplied to a load 3 from E power source, a current is restricted by the current-limiting circuit 6 to below a programmed current. At this time, a programmed current is resistance R2. It is set as the usual value.

[0016] Next, when it is not in an acceleration condition, it progresses to step S4, each component electrical potential difference of P power source flusters, and it is judged whether it is ******. If there is no dispersion in an electrical potential difference, it will progress to step S5 and will be resistance R2 by the resistance change-over switch. It switches to a side. At this time, the output current from the E power source 1 is restricted to below the programmed current that is the usual value. This restricted current is supplied to a load 3, or is supplied to the P power source 2, and the P power source 2 is charged.

[0017] If there is dispersion in an electrical potential difference, on the other hand, it will progress to step S6, and will be resistance R3 by the resistance change-over switch. It is switched to a side. In this case, since there is dispersion in

an electrical potential difference, the electric double layer capacitor of P power source is in the condition that degradation is started. Then, resistance R3 in the current-limiting circuit 6 By switching to a side, the value of a programmed current is set as a value smaller than the usual value (resistance resistance R2 programmed current at the time of being switched to a side). Consequently, the output current from the E power source 1 is supplied to P power source, and P power source is charged. In this case, since a current value becomes small, P power source is charged gradually and dispersion in an electrical potential difference is canceled. Consequently, degradation of the electric double layer capacitor which constitutes the abnormality increase and the P power source 2 of an electrical potential difference in the P power source 2 can be prevented.

[0018] Next, drawing 6 and drawing 7 explain other examples of the hybrid power control of this invention. In drawing 6 , the same sign is given to the same part as the example of this invention shown in drawing 3 and drawing 4 , and the explanation is omitted. In this example, the degradation judging means 14 is established instead of the electrical-potential-difference dispersion detection means 10. That is, this degradation judging means 14 detects the promotion condition of degradation of the electric double layer capacitor which constitutes P power source by detecting the increment in the internal resistance of the electric double layer capacitor which constitutes P power source, reduction of electrostatic capacity, or internal pressure.

[0019] Moreover, drawing 7 is the property Fig. of the electric double layer capacitor which constitutes P power source. Here, it is V0. A charge electrical potential difference and V1 Measurement starting potential and V2 A measurement termination electrical potential difference and T are the measuring times. As shown in this drawing 7 , internal resistance R is detectable as R=delta V/I from change part deltaV of the terminal voltage of an electric double layer capacitor. Here, I is a measurement current.